U.S.F.W.S. Fishery Leaflet
#607
#60
LIBRARY
FEB 12 1968
FISH & WILDLIFE SERVICE

The Mississippi Oyster Industry

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

Fishery Leaflet 607

UNITED STATES DEPARTMENT OF THE INTERIOR
Stewart L. Udall, *Secretary*
David S. Black, *Under Secretary*
Stanley A. Cain, *Assistant Secretary for Fish and Wildlife and Parks*
FISH AND WILDLIFE SERVICE, Clarence F. Pautzke, *Commissioner*
BUREAU OF COMMERCIAL FISHERIES, H. E. Crowther, *Director*

The Mississippi Oyster Industry

By

BRUCE W. MAGHAN

Fishery Leaflet 607

Washington, D.C.
December 1967

The Mississippi Oyster Industry

CONTENTS

	Page
Introduction	1
Reef location	3
Harvesting methods and equipment	6
Statistical evaluation	8
Causes of fluctuations in fishery	9
Acknowledgment	11
Literature cited	11

The Mississippi Oyster Industry

By

BRUCE W. MAGHAN, Fishery Biologist

Bureau of Commercial Fisheries
Exploratory Fishing and Gear Research Base
Pascagoula, Mississippi 39567

ABSTRACT

Mississippi coastal waters have been a source of oysters since precolonial days. The Eastern oyster reaches marketable size in 2 years in Mississippi. All reefs are within the limits of the Mississippi Sound, and the Mississippi Marine Conservation Commission has jurisdiction over reef rehabilitation, preservation, and expansion. This report describes how productive areas are maintained and how certain reefs are lost because of municipal and industrial wastes. It explains methods and equipment used in harvesting oysters since establishment of the fishery and shows annual landings, their value, and the number of fishermen in the fishery from 1928 to 1965.

INTRODUCTION

This report is based on literature research and interviews with various State and local officials and oystermen now concerned with the fishery.

The Eastern oyster (Crassostrea virginica) is common along the Gulf and Atlantic coasts of the United States as far north as Cape Cod and is found in scattered localities northward to Prince Edward Island in the Gulf of St. Lawrence.

The life cycle commences with a long spawning season, which begins in March and continues until November. During the season a female may produce from 15 million to 114 million eggs. Fertilization occurs when eggs and sperm are simultaneously released in the water. In 5 to 10 hours the fertilized eggs become minute free-swimming larvae, which are at the mercy of currents for about 2 weeks and may be carried considerable distances. When the shell is developed the larvae settle to the bottom. Those that manage to find a solid substratum (shells, rocks, hard bottom, and debris) develop into miniature oysters or "spat," reaching a size of about one-quarter inch in 2 weeks (fig. 1).

On the Gulf coast, oysters attain marketable size in about 2 years (fig. 2). Oysters found in shallow water in dense clusters are frequently referred to as "coon" oysters because they are often eaten by raccoons. Weatherby[1] notes that when moved to deeper water and thinned out, "coon" oysters grew rapidly to marketable size.

Usually the Eastern oyster can tolerate temperatures between 30° and 90° F. and salinities from 5.0 to 32.0 parts per thousand. Gulf of Mexico oysters, however, are less accustomed to severe cold and large numbers are sometimes killed during sudden freezes (Butler, 1954). Demoran and Christmas (unpublished data) of the Gulf Coast Research Laboratory recorded water temperatures and salinity from various locations including oyster producing areas in the Mississippi Sound for 1953-56 and 1962-64. During these periods average monthly water temperatures for any one location did not fall below 48° or exceed 92° F.; maximum growth occurred when the water temperature was between 51° to 68° F. Average monthly salinity for any one location did not fall below 9.71 parts per thousand; optimum growth occurred between 14 and 25 parts per thousand. The bottom type most suitable for oyster populations is relatively hard mud that is capable of supporting large amounts of shells to which the spat may attach. In Mississippi waters, oysters generally live in depths of

[1] WEATHERBY, J. H. 1930. Survey of the oyster bottoms in Mississippi Sound (revised by W. H. Dumont). A report on file with the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries Biological Laboratory, Gulf Breeze, Fla., 35 p.

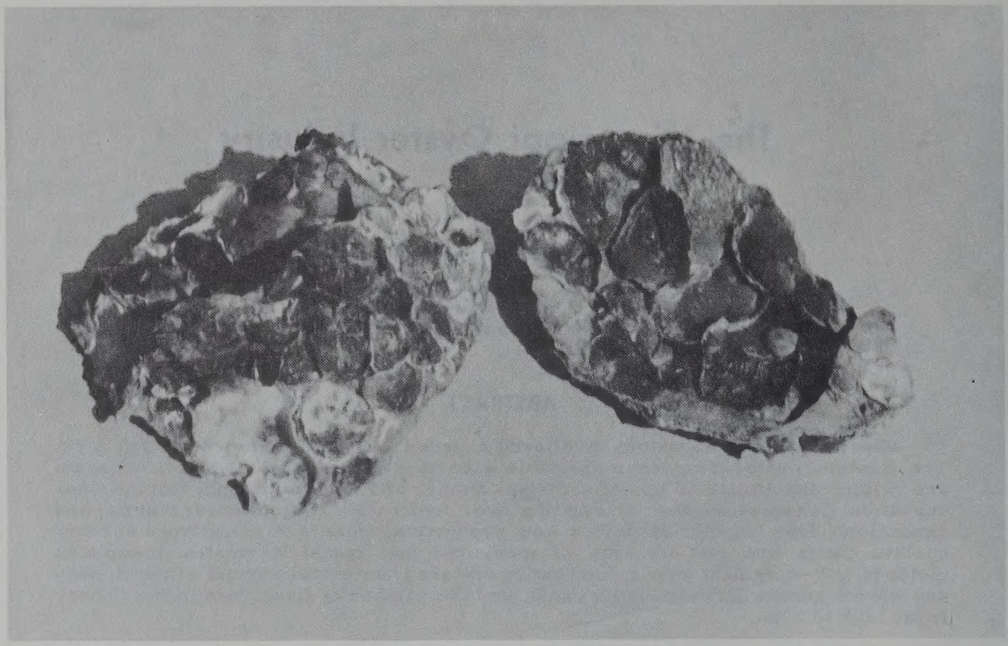


Figure 1.--Clusters of "spat" and small oysters about 1/4 to 1 inch in size attached to old shell.

less than 10 feet at mean low tide on stable bottoms not exposed to heavy wave actions or to excessive amounts of fresh water runoff; however, these areas are occasionally subjected to periods of increased salinities caused by too little rainfall (Price, 1954).

Adverse climate causes oyster mortalities by disrupting the environment. Excessive fresh water runoff that reduces salinity to less than 5 parts per thousand frequently occurs in the Mississippi Sound (Butler, 1949). This situation is brought about when excessive rainfall in the area coincides with flood conditions on the Mississippi River. Periodic opening of flood control spillways funnels large amounts of these waters into the Mississippi Sound via Lake Pontchartrain. Consequently, salinities and the amount of available food are reduced for extended periods.

Periods of too little rainfall, reducing the amount of fresh-water runoff, are responsible for increase in salinity. Damage to or destruction of oyster reefs under these conditions is attributed mainly to the influx of oyster predators rather than to high salinity (Gunter, 1952, 1953, 1955). Salinities of 30 parts per thousand or greater also inhibit growth and reproduction.

Temperatures below 42° F. or above 89° F. inhibit growth and reproduction. Oysters exposed to these extremes for extended periods may be destroyed (Galtsoff, 1964).

Drums, skates, rays, crabs, scaup ducks, and especially oyster conchs or drills, prey on the oyster. In addition, many diseases, parasites, and commensals (organisms not parasitic, but living in or on other organisms) invade shells and tissues, thus impairing the quality of oyster meats.

Other mollusks and barnacles compete with oysters for space and cause large-scale damage by fouling shells placed to catch "set" (settling larva) or smother young oysters after they become established (U.S. Fish and Wildlife Service, 1945).

A typical oyster reef consists of a low mound with the heaviest concentration of oysters on the sloping shoulders (fig. 3). If the center of the reef is exposed at low tide, oysters are periodically destroyed when exposed to excessive cold or heat for extended periods. Oyster reefs of Mississippi have been in existence for thousands of years as evidenced by large deposits of oyster shells. The shell deposits are usually under a layer of mud of varying thickness covered by 8 to 10 feet of water. Depths of the "shell banks" may range from a few inches to 25 feet or more, although their actual extent remains unknown (Butler, 1954).

In recent years, several oyster reefs have been closed as a result of municipal and industrial pollution, which are not necessarily toxic to oysters but render them unfit for

Figure 2.--Oysters (about 2-1/2 to 6 inches long) ready for harvesting. Those less than 2-1/2 inches long are returned to the water.

human consumption. Although restricted from food markets, these oysters are used as seed oysters, provided they are relocated in time to rid themselves of the detrimental substances before reaching marketable size or prior to opening of the harvesting season.

A bill passed by the Mississippi legislature gives hope that areas now closed would again be open to oyster harvesting. The legislature (Senate Bill No. 1955) provides for the creation of the Mississippi Air and Water Pollution Control Commission to establish and enforce pollution control standards. Establishment and strict enforcement of adequate standards should result in the eventual reopening of reefs now closed.

REEF LOCATION

All reefs referred to in this report occur within the limits of the Mississippi Sound, which extends from Mobile Bay on the east to Lake Borgne on the west (fig. 4). With exception of a few man-made or natural channels, its depth is less than 20 feet. Channels 2 to 3 miles wide run between islands and connect the Sound with the Gulf. The southern boundary is marked by Dauphin, Petit Bois, Horn, Ship, and Cat Islands. Total area is about 700 square miles, 80 percent of which is in Mississippi. Four rivers enter the Sound along the Mississippi coastline; from east to west, the Pascagoula, Biloxi, Jourdan, and Pearl. The latter separates Louisiana and Mississippi.

The mouth of the Pascagoula River is divided into three large openings (East, Middle, and West Rivers) that are connected by passes and bayous (fig. 5). Oysters have grown in most of these tributaries for many years. The second largest reef in the State, containing about 630 acres, is located between East and West Rivers, and was fished commercially for many years. This reef was producing $1,000 worth of oysters per day

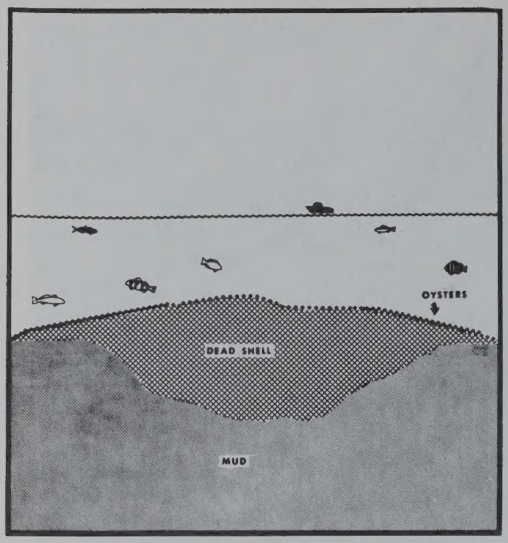


Figure 3.--Diagram of a typical oyster reef.

when it was closed by the State in 1960 because of municipal and industrial contamination (Gunter, Demoran, and Hague, 1962). It is now the primary source for seed oysters that are used to maintain public reefs. Additional important reefs occur east of Pascagoula from Bayou Casotte to the Mississippi-Alabama Middle Bay area and west of Pascagoula in Graveline Bayou.

Sixty acres of reefs exist within the limits of and in the area adjacent to Biloxi Bay, as well as in the area between Deer Island and the mainland (fig. 6). The presence of municipal and industrial contaminants has forced the State to close portions of these reefs.

The most important reef is off Pass Christian (fig. 7); this 3,000-acre reef is now the main source of oysters taken from Mississippi waters. Bay St. Louis, situated at the mouth of the Jourdan River, contains a few small reefs. An additional 80 acres of productive reefs are found in the western end of the Sound.

Mississippi reefs have always been considered public domain; however, an attempt was made in 1960 to lease some bottom off Deer Island for private use. These areas were found to be in the spoil way of a channel dredging operation; consequently, all leases and leasing plans were abandoned. Figures 5 and 6 compare locations of two important reefs in 1911 and 1962 (Moore, 1913), including areas that are now closed to taking of oysters. Locations have generally remained consistent, but fluctuations have occurred in contour and size. A chart depicting the locations of Pass Christian reef prior to World War II was not available. However, the depth of shell deposit in the substratum indicates that, like other reefs, the actual position has remained unchanged, but changes have occurred in its shape and size.

Maintenance and rehabilitation of productive reefs that have been damaged by storms, droughts, parasites, and predators have long been practiced in Mississippi. These duties are now major functions of the Mississippi Marine Conservation Commission, which was organized in 1960. Extensive planting of shells and seed oysters, biological sampling to determine conditions of oysters and oyster reefs,

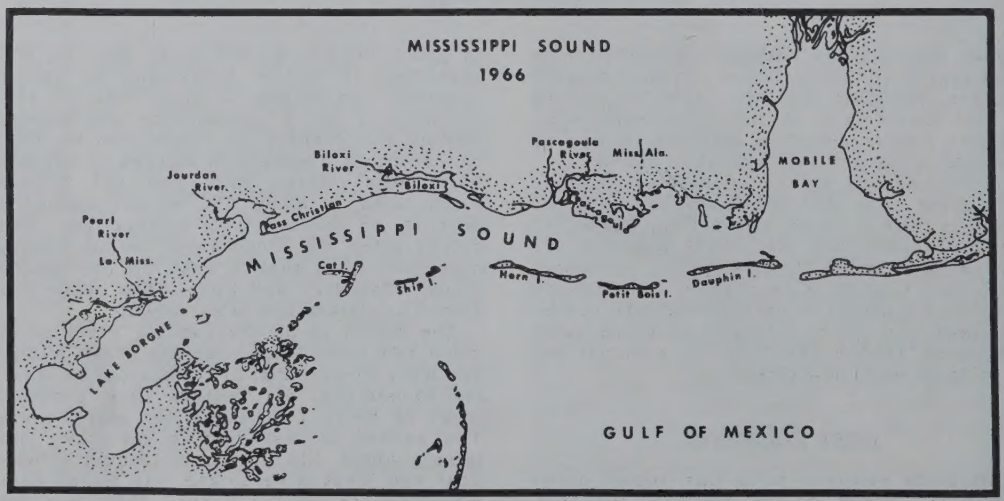
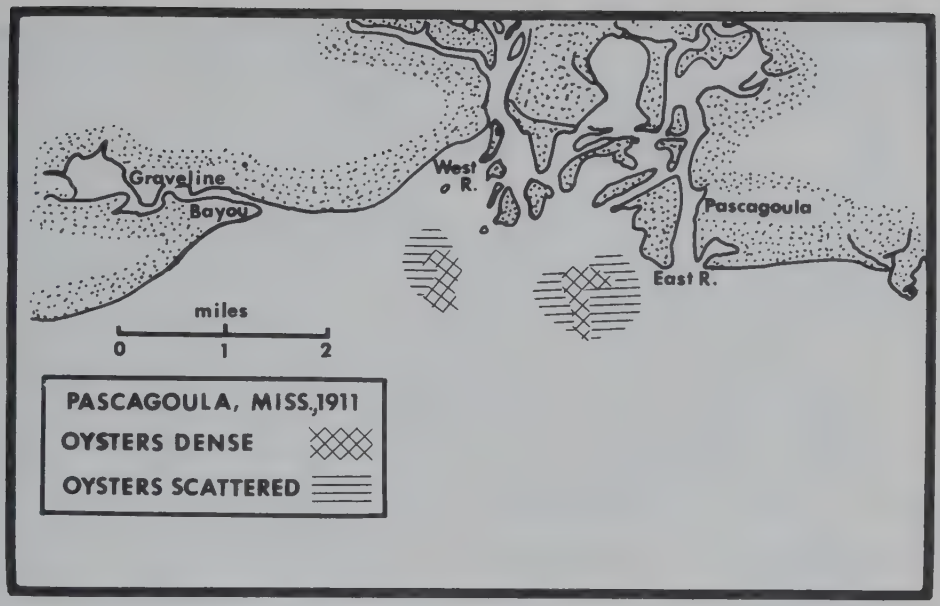


Figure 4.--Mississippi Sound, 1966.



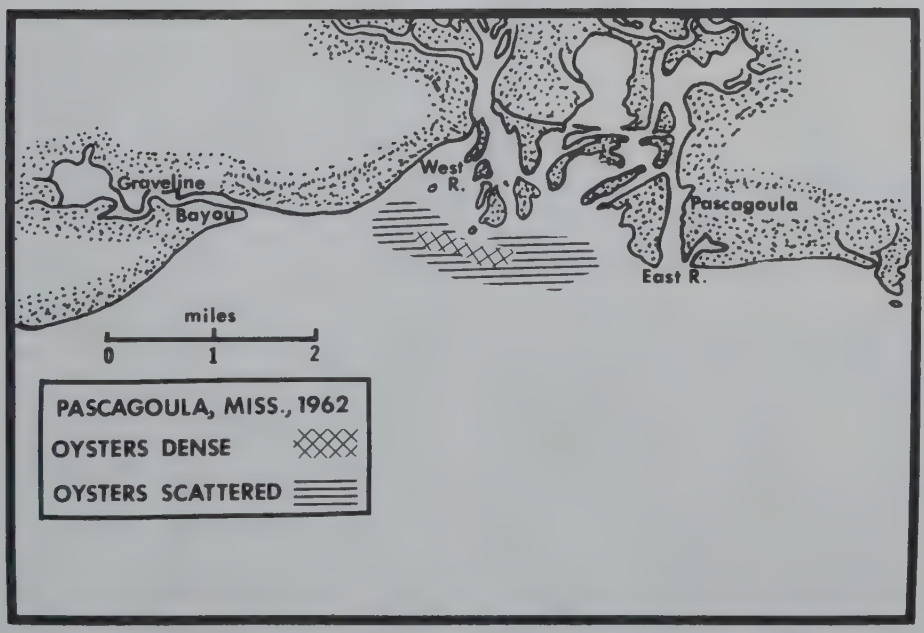
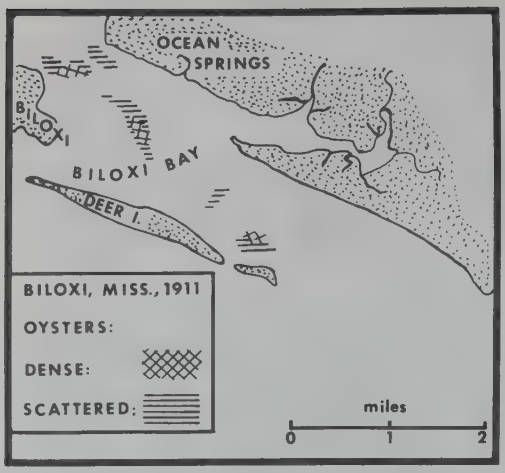


Figure 5.--The Pascagoula oyster grounds in 1911 and 1962.



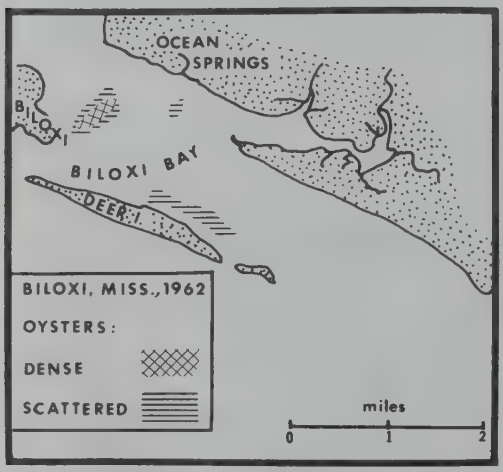


Figure 6.--Biloxi oyster reefs in 1911 and 1962.

and enforcement of State commercial fishing regulations are among the duties of the commission. It works closely with the Gulf Coast Research Laboratory in Ocean Springs, Miss.

An area is suitable for planting if the "set" or larval count is insufficient, salinity and temperatures are adequate, and the bottom is appropriate. Two methods of planting are as follows: (1) the loading of shells onto barges and moving the barges to the predetermined site where the shells are unloaded and scattered evenly over the bottom. Shells have been unloaded efficiently with high-pressure water guns (fig. 8). Mature larvae quickly attach to the planted shell, and (2) this process involves thinning out and moving seed oysters to reefs that need population replenishment because of damage from adverse weather conditions, invasions of predators, and other factors. These oysters mature, spawn, and establish the area.

Planting operations have long been practiced by the State and are now the principal methods of maintaining and expanding oyster resources. In 1960, 80,000 barrels of oyster shells were planted in Mississippi waters. An additional 45,195 barrels of shell and 3,170 barrels of seed oysters were planted throughout Mississippi oyster areas in 1966. A cooperative plan for further expansion of the Mississippi and Alabama Middle Bay area, through planting of shells and seed oysters, has been authorized by both States. Owing to favorable environmental and climatic conditions and reef maintenance and rehabilitation, as carried out by the Mississippi Marine Conservation Commission, oyster landings from Mississippi waters have substantially increased in recent years.

HARVESTING METHODS AND EQUIPMENT

Tonging is one of the principal methods of harvesting oysters from Mississippi Sound and its connecting waters. Since the earliest days, tonging has been done from relatively small skiffs and occasionally from larger vessels powered by oars, poles, and sails until the early 1930's.

Tonging, usually involving a crew of one or two, is performed from flat bottom skiffs, which are 16 to 18 feet long, 5 to 7 feet wide, and powered by an outboard motor. A pair of tongs is an elongated basket-like apparatus with 8- to 12-foot handles, depending on depth fished. Oystermen position their skiffs over the reef and extend the tongs down to the oysters, simultaneously moving the handles in a scissorlike motion to work oysters into the tongs in a groping manner (fig. 9). When the tongs are full, they are hauled on deck, the contents are deposited on a culling board and sorted. Shells and small oysters are returned to the water. This process is repeated until the day's catch is made.

Dredging is the other principal method of harvesting oysters from the Sound. Prior to 1900, dredging was done from sailing vessels in much the same way as it is today with the exception that loaded dredges were retrieved by a hand-operated winch. Size of crew varied with vessel size. Small schooners had a crew of three men, and larger vessels an average of six. In the early 1900's, oystermen from Chesapeake Bay, intending to use dredges operated from steam-powered vessels, came to Mississippi to harvest oysters from the deepwater reef located in Cat Island Channel. Soon a law

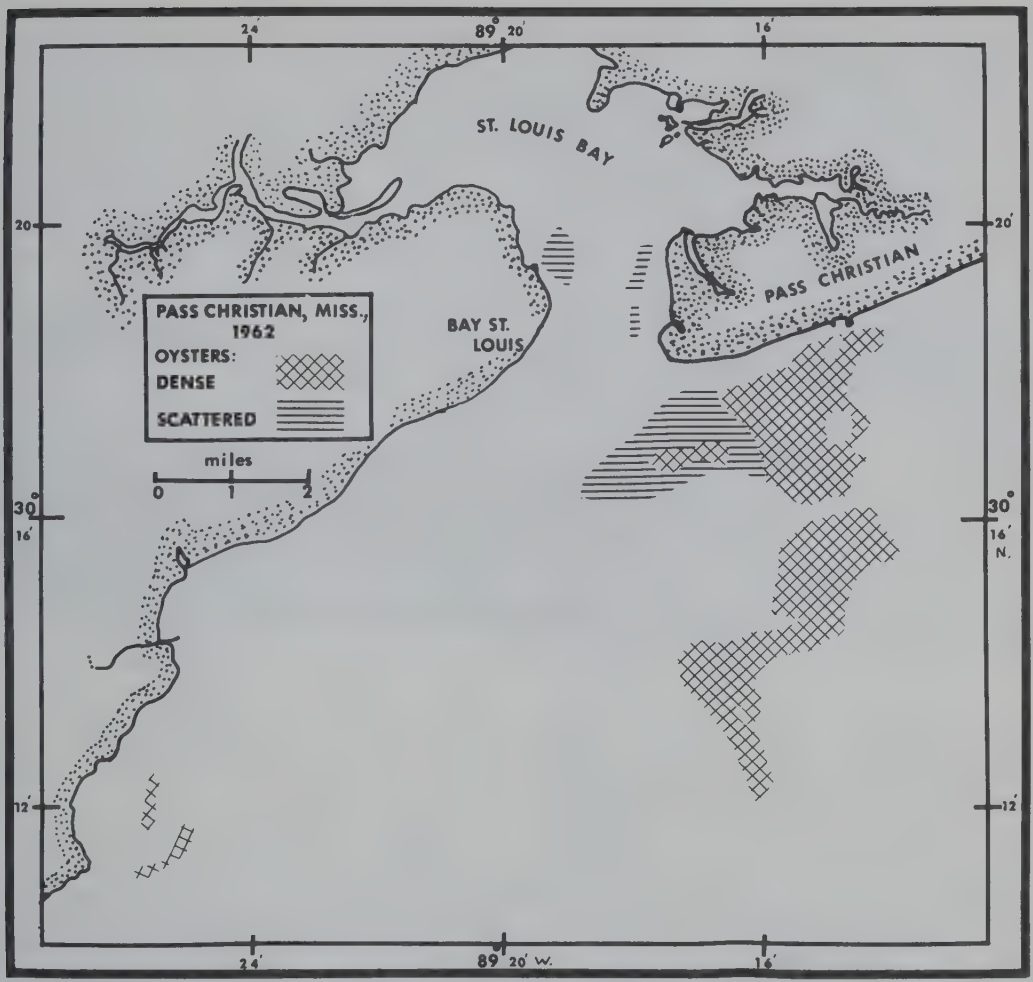


Figure 7.--Pass Christian oyster reefs, 1962.

prohibited this operation, along with other power dredging in Mississippi, but permitted dredging from sailing vessels. The early 1900's saw installation of small gasoline engines on some vessels to power dredge winches. In the early 1920's, powered dredging was again permitted on State reefs. Although individuals began installing engines to power their vessels during the 1920's, transition from sails to power was not complete until the mid-1930's. On dredging vessels, the winch that operates dredges now receives its power from the main engine.

A multiple-purpose vessel powered by a diesel engine, known as the Biloxi lugger (fig. 10) is now used in dredging operations. This vessel ranges from 30 feet length overall with a 9-foot beam and a 2-1/2-foot draft to 60 feet overall with a 17-foot beam and a 5-foot draft. Most are about 52 feet long with a 15- to 16-foot beam and a draft of about 4-1/2 feet. The vessel has a crew of 3 to 5 men.

A dredge is made of metal and has two triangular-shaped sides welded or riveted together with braces and rods. A net with metal link webbing in the bottom half and heavy twine in the top is attached to the frame. A toothed metal bar extends across the lower hind portion of the frame immediately forward of the net (fig. 11). Two dredges are usually operated from a vessel; one from each side, one slightly in front of the other. A dredge is towed over

Figure 8.--Unloading shells with a high-pressure water gun.

the reef until full and retrieved by a power winch. The contents are emptied on a culling board, sorted, and stowed. This process is repeated until the day's catch is made. Oyster dredging is restricted to Pass Christian reef and until recently was not permitted closer than 1-1/4 miles to the mainland.

STATISTICAL EVALUATION

Figures 12-14 depicting annual catches and their value and the number of fishermen in the fishery are based on data from "Fishery Industries of the United States" and "Fishery Statistics of the United States." The Bureau of Commercial Fisheries Fishery Reporting Specialist for the Mississippi coast furnished the 1961-65 statistics. Statistics are not available for the following years: 1933, 1935, 1941-44, 1946, and 1947; therefore, data for 30 years over a span of 38 years were used. Each table has the overall average plotted for easy comparison.

Annual catches in millions of pounds are plotted in figure 12. The 30-year average catch is 2,091,000 pounds. The highest catch was in 1929 (8,129,000 pounds), and the lowest in 1952 (23,100 pounds). Production was greatest for the prewar period (1928-40) when the catch averaged 3,935,900 pounds or 188.2 percent of the overall average. The postwar period (1945-59) had an average catch of 633,900 pounds or 30.3 percent of the overall average. The recent period (1960-65) averaged 1,868,900 pounds or 89.3 percent of the overall average, an increase of 59.0 percent over the postwar average catch.

The prewar average value of the catch was $167,600 (79.2 percent of the overall average); the postwar average value $160,700 (75.9 percent); and the recent average value $533,400 (191.0 percent) (fig. 13). The relatively high average value for 1950-65 can be attributed largely to price increases.

The greatest number of fishermen (1,715) was in 1939, and the least number (265) in 1951 (fig. 14). The overall average is 1,005 fishermen. The prewar average was 1,258 men (125.2 percent of the overall average); the postwar average was 723 men (71.9 percent); and the recent average was 1,511 men (150.3 percent).

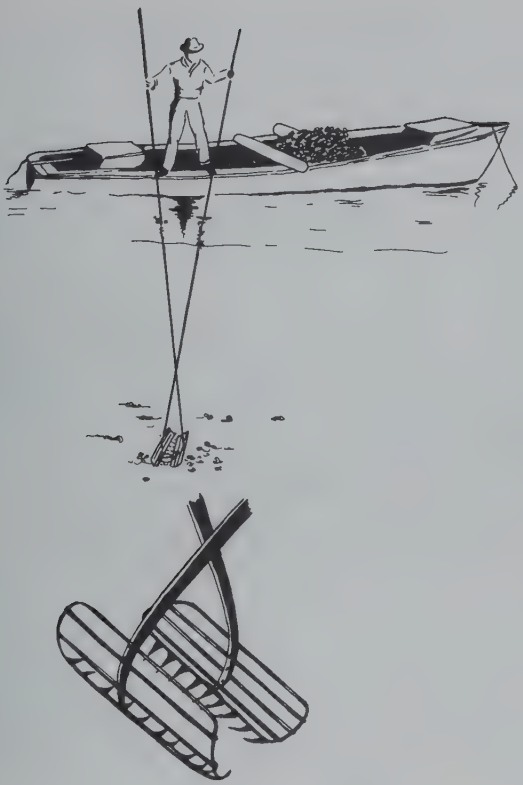


Figure 9.--Oyster tongs and their use (after Dumont and Sundstrom, 1961).

CAUSES OF FLUCTUATIONS IN FISHERY

Variations in annual catch, value, and number of fishermen are attributed to municipal and industrial pollution, predators, adverse weather, and leveeing of the Mississippi River. Increased employment opportunities in south Mississippi have resulted in a slight decline in the number of oystermen and a small catch in 1965. Preliminary statistics indicate that even fewer oyster tongers fished in 1966. Consequently, the Mississippi Marine Conservation Commission has extended the dredging season to compensate for reduced fishing effort.

Flood control levees on the Mississippi River have reduced the amount of fresh water that enters the western portion of the Mississippi Sound (Gunter, 1952, 1953, 1955). Consequently, these waters have become more saline. This increase in salinity has been accompanied by the usual influx of predators, causing additional reductions in oyster populations. Occasional low salinities in the same area result from the opening of these spillways during periods of floods. Mortalities occur if these conditions prevail for several weeks.

Despite reduction in the number of fishermen in 1965 which in turn was responsible for the decrease in the 1965 catch, recent (1960-65) annual average catch and values show considerable improvement over previous years (1945-59). Additional increases in oyster harvests are anticipated through increased planting activities and changes in fishing regulations permitting more extensive use of dredges, and when reefs now closed are reopened following abatement of municipal and industrial contaminants.

Figure 10.--A "Biloxi lugger" enters Biloxi Bay enroute to cannery. When not oyster fishing side boards and dredges are replaced with shrimping gear.

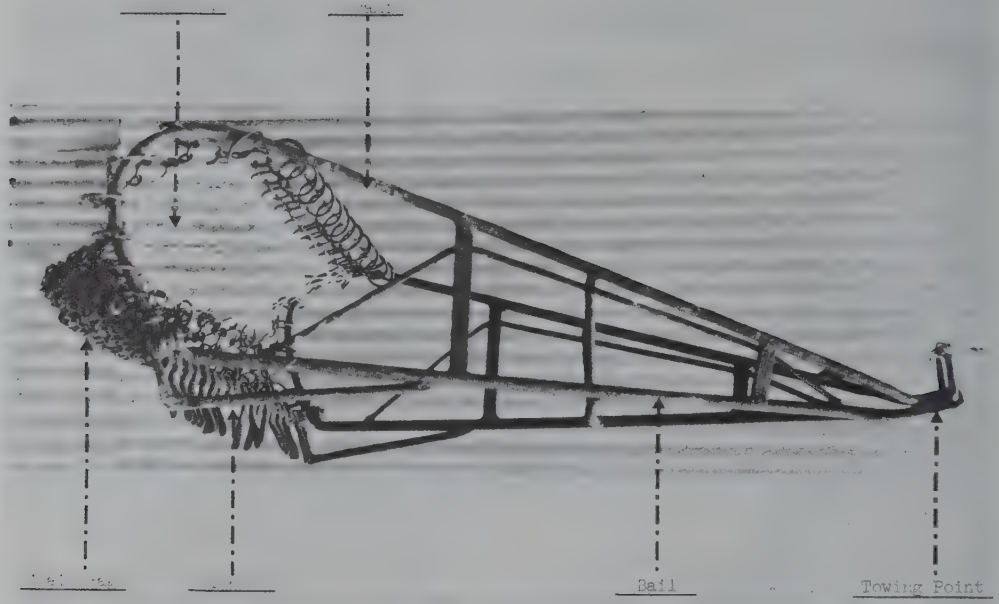


Figure 11.--A typical oyster dredge.

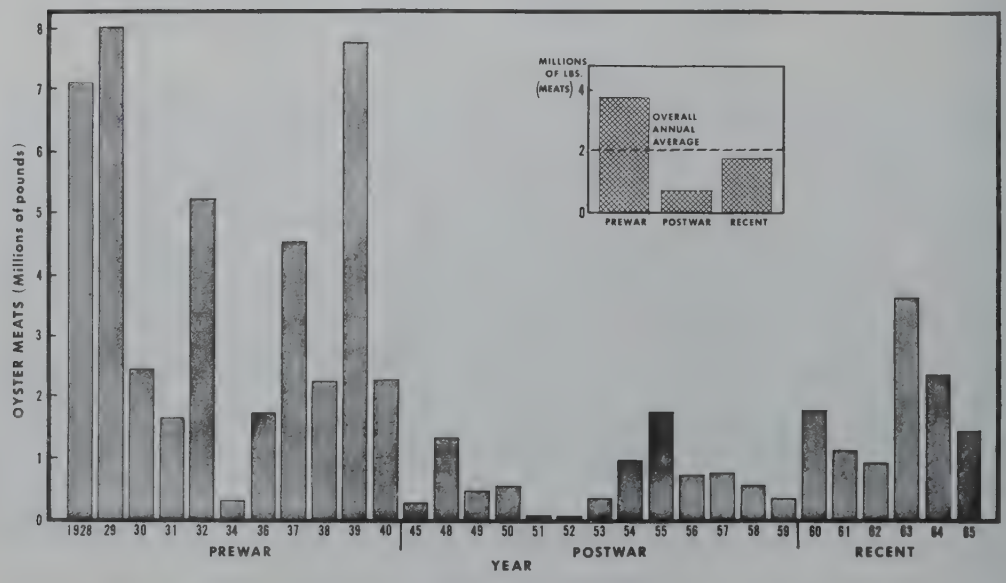


Figure 12.--Annual catches of oyster meats (million of pounds) from public waters of Mississippi.

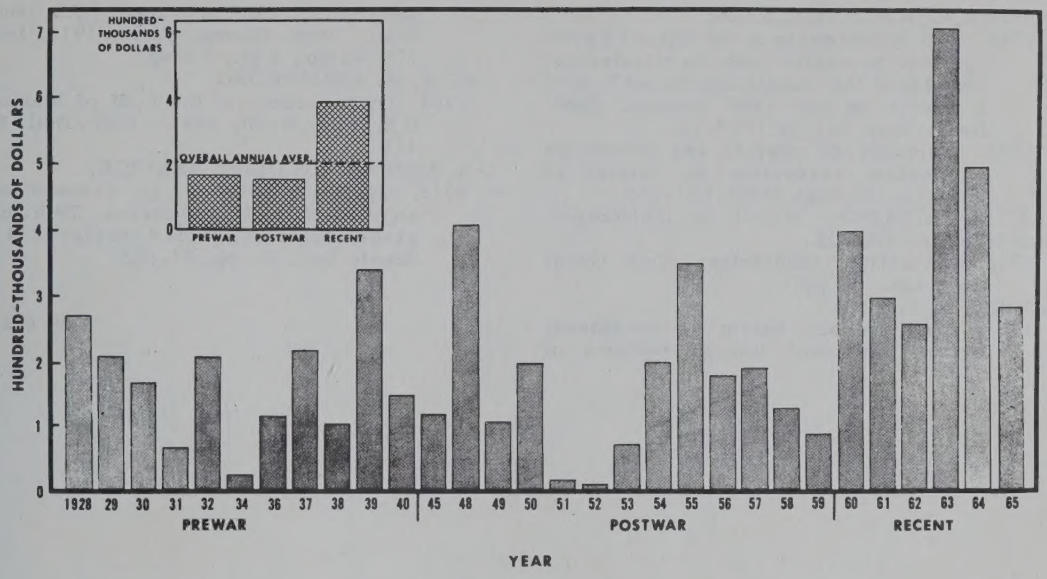

HUNDRED-THOUSANDS OF DOLLARS
HUNDRED-THOUSANDS OF DOLLARS
OVERALL ANNUAL AVER.
PREWAR
POSTWAR
RECENT
1928 29 30 31 32 34 36 37 38 39 40 45 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65
PREWAR
POSTWAR
RECENT
YEAR

Figure 13.--Value of annual catches of oyster meats taken from public waters of Mississippi.

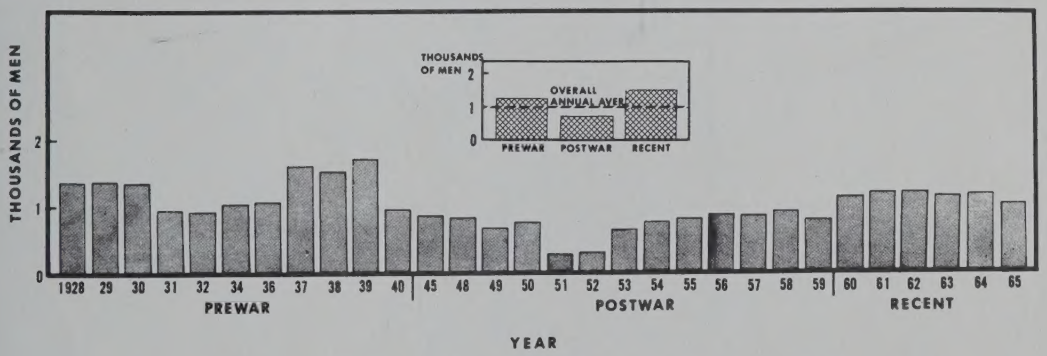

THOUSANDS OF MEN
THOUSANDS OF MEN
OVERALL ANNUAL AVER.
PREWAR
POSTWAR
RECENT
1928 29 30 31 32 34 36 37 38 39 40 45 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65
PREWAR
POSTWAR
RECENT
YEAR

Figure 14.--Number of fishermen in the oyster fishery of Mississippi.

ACKNOWLEDGMENT

The following provided facts, photographs and reference material: J. Y. Christmas, William Demoran, and Gordon Gunter of the Gulf Coast Research Laboratory, Ocean Springs, Miss.; Hermes G. Hague, Bureau of Commercial Fisheries, Pascagoula, Miss.; William Cruso, Sr., Cruso Canning Company, Biloxi, Miss.; Elmer Gautier, Mississippi Marine Conservation Commission, Biloxi, Miss.; Anthony Ragusin, Biloxi Chamber of Commerce, Biloxi, Miss.; and the late Steve M. Sekul, Sr., Sea Coast Packing Company, Biloxi, Miss.

LITERATURE CITED

BUTLER, PHILIP A.
1949. An investigation of oyster producing areas in Louisiana and Mississippi damaged by flood waters in 1945. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 8, 29 pp.
1954. Summary of our knowledge of the oyster in the Gulf of Mexico. U.S. Fish Wildl. Serv., Fish. Bull. 55: 479-489.

DUMONT, WM. H., and G. T. SUNDSTROM.
1961. Commercial fishing gear of the United States. U.S. Fish Wildl. Serv., Circ. 109, iv + 61 pp.

GALTSOFF, PAUL S.
1964. The American oyster Crassostrea virginica Gmelin. U.S. Fish Wildl. Serv., Fish. Bull. 64, pp. 397-446.

GUNTER, GORDON.
1952. Historical changes in the Mississippi River and the adjacent marine environment. Publ. Instit. Mar. Sci. 2(2): 119-139.

GUNTER, GORDON.--Continued
1953. The relationship of the Bonnet Carré Spillway to oyster beds in Mississippi Sound and the "Louisiana Marsh", with a report on the 1950 opening. Publ. Instit. Mar. Sci. 3(1): 17-71.
1955. Mortality of oysters and abundance of certain associates as related to salinity. Ecology 36(4): 601-605.
GUNTER, GORDON, WILLIAM DEMORAN, and HERMES HAGUE.
1962. Extractive industries. Gulf Coast Res. Lab., 18 pp.
MOORE, H. F.
1913. Condition and extent of the natural oyster beds and barren bottoms of Mississippi east of Biloxi. [U.S.] Bur. Fish., Rep. Comm. Fish., 1911, Doc. 774, 42 pp., 6 pl., 1 map.
PRICE, W. ARMSTRONG.
1954. Oyster reefs of the Gulf of Mexico. U.S. Fish Wildl. Serv., Fish. Bull. 55: 491.
U.S. FISH and WILDLIFE SERVICE.
1945. Oyster resources. In Fishery resources of the United States. 79th Congress, 1st sess. [vol. 4, serial 10941], Senate Doc. 51, pp. 97-102.

MS. #1689

GPO 932-364

Created in 1849, the Department of the Interior--a department of conservation--is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States--now and in the future.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES
WASHINGTON, D.C. 20240

OFFICIAL BUSINESS

Return this sheet to above address, if you do NOT wish to receive this material ☐, or if change of address is needed ☐ (indicate change including ZIP Code).

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF THE INTERIOR
THIRD CLASS